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**GRADO EN ADMINISTRACIÓN Y DIRECCIÓN DE EMPRESAS Y
ECONOMÍA INTERNACIONAL**

**THE ENERGY BURDEN: THE DEPENDENCE ON ENERGY IMPORTS OF
THE OECD COUNTRIES**

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ABSTRACT

In this bachelor's thesis, we are going to analyse whether the ease of access to energy had an impact on economic growth using a sample of the OECD member countries. We are also going to make a comparative analysis of the situation of Spain and the rest of OECD member countries. Data has been obtained from United Nations COMTRADE database and Maddison Project database. We find strong evidence that countries with more difficulties to access energy had a worse economic performance than those which have an easier access. A panel model with random effects is done in order to test for net energy imports coverage effect on GDP growth.

KEY WORDS

Energy, Energy Imports Coverage, OECD, Spain, Petroleum, Coal, Natural Gas, Electricity.

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1. INTRODUCTION

The choice of this topic comes from the interest developed during the collaboration grant provided by the Public University of Navarre. During several months I have been working in the Economics Department, particularly in topics related with Energy Economics.

We have always heard that Spain has had huge problems with its economic development due to the lack of coal, the non-metallic mineral most important in the first industrial revolution, and also because of the scourge of their natural resources endowment related with the second industrial revolution (oil, bauxite, chrome or silicon). In comparison with a great number of developed countries, the Spanish industrial development was severely lagged as a consequence of coal's scarcity and quality.¹ In addition, the physic configuration of the peninsula has not helped to mining activities due to the fact that tectonics had resulted in costly and difficult mining activities. It is well know that Spain has a very rugged landscape and so is its subsoil, where we can find plenty of faults and crust foldings. The direct consequence of this, affects coal seams, meaning that they are vertical or very steep and furthermore, very fragmented, making coal's extraction a very difficult task and obtaining many useless rocks as a product.

Continuing along this line, it is also notorious that the Spanish peninsula has not huge amounts of crude oil nor natural gas causing that Spain has an important dependence on these goods imports. Spain possesses various oil and gas deposits, the first one discovered dates from 1964 in Ayoluengo (Burgos)² containing oil and the following had been discovered all over the geography in places such as the Mediterranean sea, the gulf of Valencia, the Cantabric Sea, the Guadalquivir Valley and the gulf of Cádiz. In 2014 domestic crude oil production was 305.411 tons and natural gas production totalled 268,900 GWh, representing a degree of self-sufficiency of 0.57% and 0.09% respectively, over total domestic consumption.³

Last but not least we have to mention hydraulic energy, where the enormous human and economic effort made throughout the twentieth century for the construction of many hydroelectric power stations, has placed Spain among the countries with one of the largest

¹ Carreras, A. and Tafunell, X. (2010). *Historia económica de la España contemporánea (1789-2009)*. Barcelona: Crítica editorial.

² Puche Riart, O., Mazariago Martínez, L. F. y Ortiz Menéndez, J. E. (2011): Petroleum in the Spanish Iberian Peninsula. *Cuadernos del Museo Geominero*, 13, 227-238.

³ CORES, Informe Estadístico Anual 2014. Retrieved 9 March 2016, from <http://www.cores.es/sites/default/files/archivos/publicaciones/informe-estadistico-anual-2014.pdf>

hydroelectric parks in the world. Only large nations such as the United States or Canada, or very mountainous countries with large water resources such as Brazil account with larger hydroelectric parks than Spain. The production of hydroelectricity still has a significant role in the total electricity production and it should be considered as a strategic sector the country since it has to import most of the energy products that it consumes. However, the development of this potential currently faces major limitations: firstly because the construction of new hydroelectric plants of medium or large size comes increasingly into conflict with other important alternative uses of water and soil, and secondly because much of the potential sites are located in difficult places or involve making complex and costly civil works which considerably increase the cost per kWh produced.⁴

The direct consequence of this small energetic natural resources endowment has been reflected in the fact that the greatest part of the energy supplies has had to be imported. Causing the consequent limiting effects on the capability to import other goods. The main objective of this work, is through a comparison of the Organization for Economic Cooperation and Development member countries, from now onwards OECD, analyse whether the energy burden that has faced Spain has been something exclusive of the country. Moreover, we have always been told that energy supply has been, for long periods of our history, a drag on economic growth and that it has had a negative impact on the competitiveness of companies and, in some cases, has hampered the functioning of the national economy.⁵ This project will also try to discover the consequences of being an exporter or importer of energy and in the case of those importers analyse whether its impact is as severe as we have been always been told.

The rest of the study is structured as follows. In section 2 there is a brief revision of previous literature and a description of the main objectives of this bachelor's thesis. In section 3 we have the presentation of the database. In section 4 we have a descriptive analysis of the results we Spain is analysed and then a comparison between the OECD and Spain is established. In section 5 we use a random-effects model in order to test the relationship between net energy imports coverage and GDP growth. Finally in section 6 we comment the main conclusions of this study.

⁴ Espejo Marín, C. and García Marín, R. (2010). *Agua y energía: producción hidroeléctrica en España*. INGEO, 51, pp.107-129.

⁵ Sudriá, C (1997). "La restricción energética al desarrollo económico de España", *Papeles de Economía Española*, p. 165-188.

2. PREVIOUS LITERATURE AND OBJECTIVES

Mankind has always aimed to increase the quantity and quality of goods and services consumed. With a very long-term view, the evolution of humanity could be based on a search for mechanisms in order to access greater energy consumption that lead to this increase in quality and quantity of goods and services consumed. This means that energy plays a vital role in an economy affecting both the demand and supply. On the demand side, it is one product that consumers decide to purchase in order to maximise their utility and on the supply side, it is a key factor that combined with labour, capital and materials, affects the socio-economic development of a country by increasing economic growth and living standards.⁶

The literature about this topic starts with John Nef, he was the first historian that pointed out energy as the main trigger of the industrial revolution. According to him, the industrial revolution was a long-term path that started at the end of the 16th century in Great Britain with a transition from woodcutting to coal mining and then was spread and strengthened during the next two centuries.⁷ The main cause for this event was that Great Britain ran out of wood⁸, resulting in the adoption of a new fuel, in this case coal, aspect that allowed the earlier revolution of the British economy, changing its history, the European and later on the history of the whole World.

Carlo Cipolla, another great economic historian that also covered the topic, stated that two great revolutions took place in the human's history and that both of them were correlated with deep changes in energy availability. The first one consisted in the transformation into farmers and herdsmen of those that previously were hunters and gatherers. The second one made, those farmers and herdsmen, became the operators of "mechanical slaves" fed with inanimate energy.⁹ The main reason behind this shift into operators of "mechanical slaves" was the movement from wood to coal that took place between 1550 and 1770, allowing the development of new manufacturing methods and industries as well as the expansion of the existing ones. As John Nef, Cipolla also recognized that this movement was motivated by the shortage caused by excessive cutting of firewood for metallurgy,

⁶ Chontanawat, J. (2006). *Causality between Energy Consumption and GDP: Evidence from 30 OECD and 78 Non-OECD Countries*.

⁷ Nef, J. (1932). *The rise of the British coal industry*. London: G. Routledge.

⁸ Nef, J. (1977). An Early Energy Crisis and its Consequences. *Sci Am*, 237(5), 140-151.

⁹ Cipolla, C. (1978). *Historia económica de la población mundial*. Barcelona: Crítica.

which required intensive energy use and faced the high melting point of iron leading England to replace wood for coal.

During the recent years, the interest on energy and its correlation with the transition from the old to the modern economy has been growing and growing. Its importance has been acknowledged as the key trigger of the divergence between Western Europe and the rest of the world during the 19th century and main cause of the European success. The causal relation between energy consumption and GDP has become into a well-studied topic by economists and policymakers and there exist a great number of studies covering the field. Some seek to answer if energy consumption is a stimulus for economic growth while others analyse whether economic growth is a stimulus for energy consumption. The reason behind this large number of investigations resides into the fact that the direction of causality has significant policy implications. In the case that energy consumption is a key component in economic growth, those policies that aim to reduce energy consumption may harm real GDP, however, if the causality runs from economic growth to energy consumption the effect of these policies has little or no negative effect on economic growth.¹⁰ Unfortunately the results obtained varied across countries and even across time periods for the same countries.¹¹

Into the literature we can find four different views covering this relationship between energy and economy:¹²

- *Growth hypothesis*

Unidirectional causality from energy consumption to economic growth. It implies the energy dependence of economies and also that no or limited access to energy supply can limit economic growth.

- *Conservative hypothesis*

Unidirectional causality from economic growth to energy consumption. It suggests that energy conservation policies will have no adverse effect on economic growth. The hypothesis is reinforced if an increase in GDP leads to an increase in energy consumption.

¹⁰ Eggoh, J., Bangake, C., & Rault, C. (2011). Energy consumption and economic growth revisited in African countries. *Energy Policy*, 39(11), 7408-7421.

¹¹ Soytas, U., & Sari, R. (2003). Energy consumption and GDP: causality relationship in G-7 countries and emerging markets. *Energy Economics*, 25(1), 33-37.

¹² Yildirim, E., & Aslan, A. (2012). Energy consumption and economic growth nexus for 17 highly developed OECD countries: Further evidence based on bootstrap-corrected causality tests. *Energy Policy*, 51, 985-993.

- *Feedback hypothesis*

Bidirectional causal relation between economic growth and energy consumption, implying a mutual and complementary relationship between both variables.

- *Neutrality hypothesis*

This view argues that there is no causal relation between economic growth and energy consumption. Both variables are neutral with respect to each other.

In what refers to OECD countries all four hypotheses have been evidenced. Soytaş and Sari¹³ (2003) defend the growth hypothesis in one study covering Turkey, France, Japan and Germany. On the other hand, Lee¹⁴ (2006) and Lise and Van Montfort¹⁵ (2007) defend the conservative hypothesis for Japan and Turkey respectively. Cserekley, Rubio-Varas and Stern¹⁶ (2016) are also in favour of the conservative hypothesis since, in their study for 99 countries covering the period 1971 to 2010, they concluded that in the absence of economic growth there are no improvements in energy intensity on average. Bartleet and Gounder¹⁷ (2010) and Belke, Dobnik and Dreger¹⁸ (2011) found evidence of the feedback hypothesis in their studies covering New Zealand and 25 OECD countries respectively. Last but not least, Menegaki¹⁹ (2011) found no evidence of causality between the two variables in her study for 27 European countries.

The review of the literature covering this topic finds, in general, a strong causal relationship between energy consumption and economic growth but is inconclusive about the direction of the causality and the magnitude of its impact. That is the reason why the purpose of this project is to introduce a different view by looking at energy supplies imports and exports in order to prove these hypothesis relating economy and energy. We are going to analyse the relationship from a different angle which is not so much about the amount of energy

¹³ Soytaş, U., & Sari, R. (2003). Energy consumption and GDP: causality relationship in G-7 countries and emerging markets. *Energy Economics*, 25(1), 33-37.

¹⁴ Lee, C. (2006). The causality relationship between energy consumption and GDP in G-11 countries revisited. *Energy Policy*, 34(9), 1086-1093.

¹⁵ Lise, W., & Van Montfort, K. (2007). Energy consumption and GDP in Turkey: Is there a co-integration relationship?. *Energy Economics*, 29(6), 1166-1178.

¹⁶ Cserekley, Z., Rubio-Varas, M., & Stern, D. (2016). Energy and Economic Growth: The Stylized Facts. *EJ*, 37(2).

¹⁷ Bartleet, M., & Gounder, R. (2010). Energy consumption and economic growth in New Zealand: Results of trivariate and multivariate models. *Energy Policy*, 38(7), 3508-3517.

¹⁸ Belke, A., Dobnik, F., & Dreger, C. (2011). Energy consumption and economic growth: New insights into the cointegration relationship. *Energy Economics*, 33(5), 782-789.

¹⁹ Menegaki, A. (2011). Growth and renewable energy in Europe: A random effect model with evidence for neutrality hypothesis. *Energy Economics*, 33(2), 257-263.

consumption and its relationship with economic growth but rather a more indirect approach. In this project we will try to answer the question of whether the ease of access to energy had any impact on economic growth. The hypothesis that we have are going to test is if countries with more difficulties to access energy, because they have to import it, had a worse economic performance than those countries which have an easier access. This easier access can be determined by the fact that they are energy producers or because the effort that they have to realize in order to import energy is small in relation with their export and import capacity.

3. THE DATABASE

In order to have a diversified list of countries we have decided to use the *Organisation for Economic Co-operation and Development* (OECD) member countries. This decision was adopted due to the fact that this list offers a varied number of countries that span the globe, from Europe and Asia-Pacific to North and South America. They include many of the most advanced countries, but at the same time emerging ones; which make possible to find both energy importers and exporters and also some countries which were first energy exporters and nowadays act as net importers.

As of 12th March 2016, the OECD had the following 34 members²⁰:

²⁰ *List of OECD Member countries - Ratification of the Convention on the OECD - OECD.* (2016). *Oecd.org*. Retrieved 12 March 2016, from <http://www.oecd.org/about/membersandpartners/list-oecd-member-countries.htm>

1. AUSTRALIA	13. HUNGARY	25. PORTUGAL
2. AUSTRIA	14. ICELAND	26. SLOVAKIA
3. BELGIUM	15. IRELAND	27. SLOVENIA
4. CANADA	16. ISRAEL	28. SOUTH KOREA
5. CHILE	17. ITALY	29. SPAIN
6. CZECH REPUBLIC	18. JAPAN	30. SWEDEN
7. DENMARK	19. LUXEMBOURG	31. SWITZERLAND
8. ESTONIA	20. MEXICO	32. TURKEY
9. FINLAND	21. NETHERLANDS	33. UNITED
10. FRANCE	22. NEW ZEALAND	KINGDOM
11. GERMANY	23. NORWAY	34. UNITED STATES
12. GREECE	24. POLAND	

This research uses United Nations COMTRADE database, on an annual frequency of OECD countries trade balances related to coal, coke and briquettes imports and exports; petroleum and petroleum products imports and exports; gas, natural and manufactured imports and exports and finally, electric energy imports and exports. The classification of goods used is the Standard International Trade Classification (SITC²¹), which was developed by the United Nations so that traded goods can be classified not only on the basis of their material and physical properties, but at the same time according to their stage of processing and their economics functions which helps realizing economic analysis.

The documents downloaded show for every country the value, on current USD (\$), of all the exported commodities, the exported coal, coke and briquettes, the exported gas both natural and manufactured, the exported electric energy and the exported petroleum and petroleum products. Moreover, the database also provides information, on current USD (\$), of all the imported commodities, the imported coal, coke and briquettes, the imported gas both natural and manufactured, the imported electric energy and the imported petroleum and petroleum products.

The time series studied covered the last 50 years of these 34 OECD member countries (1962 to 2014) due to the fact that this repository of official trade statistics contain information starting from 1962. However, we have to take into account several aspects of

²¹ The categories used were: 32- *Coal, coke and briquettes*; 33- *Petroleum and petroleum products*; 34- *Gas, natural and manufactured*; 35- *Electric Energy*. The database can be accessed in the following webpage: <http://comtrade.un.org/data/>

the selected countries that make impossible to have data for the whole time period studied. These are the following:²²

- Belgium and Luxembourg reported the information together until 1999.
- The Czech Republic and Slovakia were part of Czechoslovakia until the 1st January 1993, when the state peacefully dissolved into the Czech Republic and Slovakia. We have data for the Czech Republic starting from 1993 and from 1994 for Slovakia.
- Estonia was part of the Soviet Union until the regaining of its independence in 1991, we have data available for this country starting in 1995.
- Germany was divided into the German Federal Republic and the Russian-dominated German Democratic Republic since 1949 until 1989 when both territories were reunified forming Germany again. We have data available for the Federal Republic of Germany between 1962 and 1990, and between 1985 and 1990 for the Democratic one, the database of Germany starts from 1991.
- Poland was invaded in 1939 by both Germany and Soviet Union and became a communist dictatorship under Russian domination. In 1980 emerged the non-communist trade union Solidarity that achieved the downfall of communism in 1989. The data available in the United Nations database dates from 1984 on.
- Slovenia became part of the communist Republic of Yugoslavia in 1945 and was not proclaimed independent until 1991 after a referendum in 1990. The database starts from 1992.

Once the files were downloaded and converted into excel, we have calculated several variables:

- *Total value of the exported energy supplies:* This variable quantifies all the exported energy supplies and in order to obtain it, by adding the values of the different kind of energy carriers exported for every country and year.
- *Total value of the imported energy supplies:* This variable quantifies all the imported energy supplies and in order to obtain it, adding the value in dollars of the different kind of energies imported for every year and country.
- *Net energy imports:* I have obtained this variable by subtracting for every country and year the total value of the exported energy supplies to the total value of the imported energy supplies, when the value obtained is positive it means that the

²² Slomp, H. and Slomp, H. (2011). *Europe, a political profile* (pp.357-574). Santa Barbara, Calif.: ABC-CLIO.

country was an net importer of energy and if the value is negative value it means that the country was a net exporter of energy.

- *Energetic importer effort*: This variable is calculated by dividing the total value of the imported energy supplies by the value of total imports. It measures the cost of importing energy in comparison with the cost of all imported goods and it is expressed as a percentage.
- *Energy imports coverage*: This variable represents which percentage of total exports are equivalent to the total value of the imported energy supplies. In order to calculate it we have divided the total value of the imported energy supplies by the value of total exports. It is one of the most useful variables since it going to an answer the question how much of the hard earned currency obtained by exporting goods go to paying for the energy imports.

We have used other variables that have allowed me to establish comparisons and at the same time provide more information, since the data was showing values on current USD (\$) and there are significant differences between the volumes of imports and exports of the countries selected for this study. These are:

- *Weighted Average*

Due to the different sizes among OECD countries and their different volumes of energy imports and exports, we have used this average measure in which each country received a weight according to their energy exports or energy imports over the total energy exports or imports realized by the OECD during each year. These weightings inform about the importance of each country on the average.

Imports

$$Weight\ Country_i\ year\ x = \frac{Country_i\ energy\ imports\ year\ x}{\sum_{i=1}^{37} Country_i\ energy\ imports\ year\ x}$$

Energy imports weighted average year x

$$= \sum_{i=1}^{37} (Country_i\ imports\ year\ x \times Weight\ Country_i\ year\ x)$$

Exports

$$Weight\ Country_i\ year\ x = \frac{Country_i\ energy\ exports\ year\ x}{\sum_{i=1}^{37} Country_i\ energy\ exports\ year\ x}$$

Energy exports weighted average year x

$$= \sum_{i=1}^{37} (\text{Country}_i \text{ exports year } x \times \text{Weight Country}_i \text{ year } x)$$

- *Energy exports over total exports*

In order to provide more useful information than the *Total value of the exported energy supplies* we have divided this variable by the *Total value of the exported commodities* in order to see what percentage of total exported commodities were energy exports.

- *Energy imports over total imports*

In order to provide a more suitable information than the *Total value of the imported energy supplies* we have divided this variable by the *Total value of the imported commodities* in order to see what proportion of total imported commodities were represented by energy imports.

- *Net energy imports over total imports*

In order to provide more suitable information than the *Net Energy Imports* we have divided this variable by the *Net Commodities Imports* in order to see what proportion of total net commodities imports were represented by net energy imports.

- *Imports basket composition and Exports basket composition*

These baskets show the relative share of each of the different energy sources in the total value of the imported or exported energy supplies. These baskets are calculated by dividing the total value of each of the imported or exported energy supplies (petroleum and petroleum products, natural and manufactured gas, coal, coke and briquettes and electric energy) by the respectively sum of all the imported or exported energy supplies.

4. Descriptive Analysis

We would like to analyse the results in two different steps. Firstly by analysing everything concerning Spain so that we can develop an idea about how the country has acted during the period studied and secondly, by comparing Spain with the OECD member countries so that we can discover the similarities and differences among the Mediterranean country and the different members of the organization.

4.1 Spain

- *Exported energy supplies*

During the period covered (1962-2014), Spain has exported energy supplies for a total amount of \$215.355.673.718, which means that the country exported \$4.063.314.598 energy supplies per year on average. Energy exports have represented about 4.44% on average over Spanish total exports, being 1985 the year with the greatest weight when they represented 8.12% of total exports. On the other hand, in 1995 energy exports only represented 1.6% of total exports.

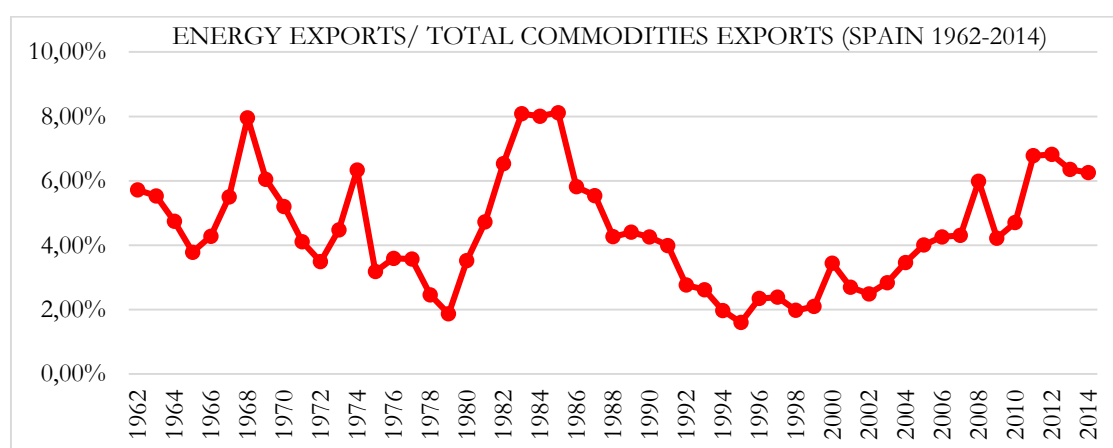


Fig.1

Source: Own compilation from COMTRADE database

Figure 2 shows us the composition of the Spanish exports basket, it is quite remarkable the importance that Petroleum and Petroleum products have on it. The reason behind this statement comes from 1927, when the *Compañía Arrendataria del Monopolio de Petr6leos Sociedad An6nima (CAMPESA)* was founded having as one of its aims the development a refining industry in the country. Since 1967, the refining capacity of Spain has been higher than its domestic demand, allowing the country to export the surplus²³. However, we should also consider electric energy during the period 1964-1973, which on average weighted 17.56% and reached a maximum on 1966 with 40.75% of the total value of the basket. During the last part of the period studied (2012-2014), when can clearly appreciate how gas, natural and manufactured has been increasing its weight into the Spanish basket, until the point of reaching a maximum value of 14.87% of the basket during 2014. The reason behind the previous statement is the crisis that has been affecting the country and

²³ Trythall, J., & Wright, A. (1978). The Spanish Economy 1959-1976. *International Affairs* (Royal Institute Of International Affairs 1944-), 54(2), 325.

that has diminished domestic demand of these resources²⁴. However, electric and gas companies are obliged to continue buying liquid natural gas (LNG) volumes under their long-term contracts. The solution has been to re-export of LNG to Premium destinations, such as Asia and South America.²⁵

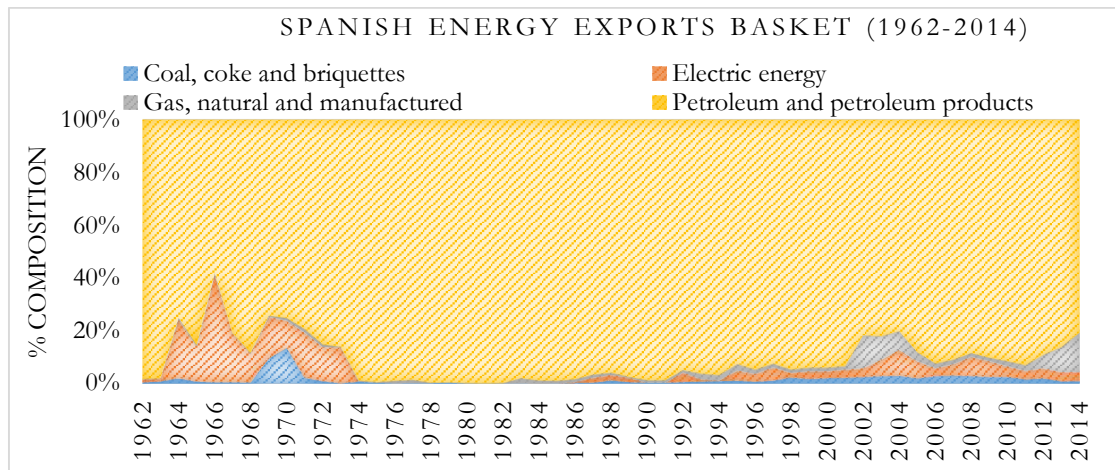


Fig. 2

Source: Own compilation from COMTRADE database

■ *Imported energy supplies*

During the period covered (1962-2014), Spain has imported energy supplies worth \$988.365.849.156, which means that the country imported \$18.648.412.248 energy supplies per year on average. Energy imports have represented about 14.8% of total imports on average during the period studied. As we can appreciate on figure 3, there exist three clear tendencies in what energy imports concerns. The first one (1962-1985) where its weight over total imports is rising, especially between 1973 and 1985 as a direct effect of the recession and macroeconomic imbalances that were affecting Spain (less investment, public deficit, inflation, unemployment and external deficit)²⁶ and the first oil crisis of 1973, time when oil was the dominant not only in transport, but also had great weight in the industrial and electric sector²⁷. The second one (1986-1999) where its weight is declining, coincides with the European integration of the country and also with a period (the second half of the

²⁴ Shiryayevskaya, A., & Mengeweine, J. (2014). *Gas Carousel Making Spain Europe's Biggest LNG Exporter*. Bloomberg.com. Retrieved 9 April 2016, from <http://www.bloomberg.com/news/articles/2014-04-10/gas-carousel-making-spain-europe-s-biggest-lng-exporter>

²⁵ Vukmanovic, O. (2016). *Gas price convergence stalls Spanish LNG exports*. Reuters UK. Retrieved 9 April 2016, from <http://uk.reuters.com/article/uk-spain-lng-global-gas-idUKKBN0NK2BU20150429>

²⁶ Carreras, A., & Tafunell, X. (2010). *Historia económica de la España contemporánea (1789-2009)*. Barcelona: Crítica editorial. Cap. 9 "Crisis económica y transición política (1974-1985)"

²⁷ Aranzadi, C. (2014). «Política energética y regulación. Teoría y Práctica» en *Energía y Regulación*, Orkestra. Fundación Deusto.

1980s) where Spain enjoyed the strongest growth among OECD countries, both in terms of production and employment generation. Perhaps this entrance into the European Union hides the negative effect of the European monetary crisis of 1992-1993 since no peak is observed in the figure 3 during that period. Finally we have the third tendency where energy imports weight over total commodities imports is rising again, coinciding with the arrival of the euro, the third oil shock and the global financial crisis. The maximum weight was achieved in 1981 when energy imports represented 29.83% of the Spanish total imports of commodities during that year.

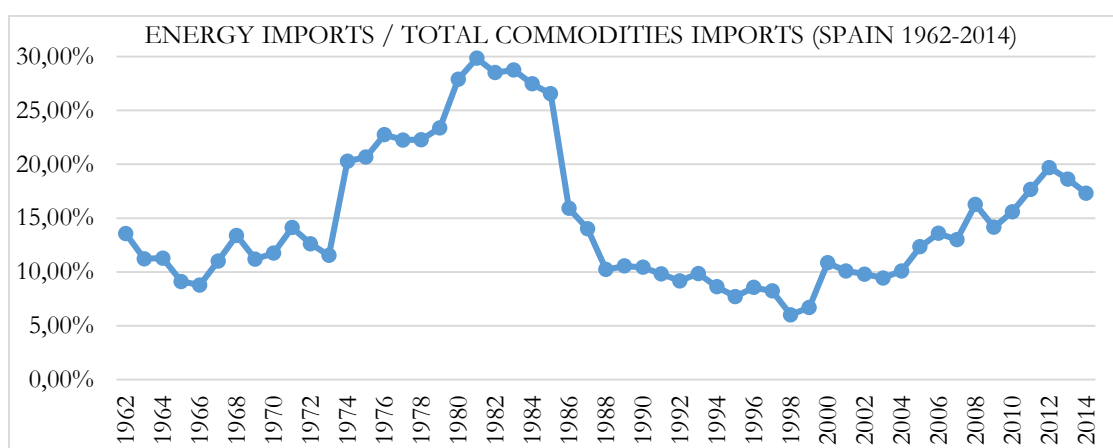


Fig.3

Source: Own compilation from COMTRADE database

As it was in the Spanish exports basket, it is quite notable the importance that petroleum and petroleum products had on the imports basket. The maximum weight achieved by petroleum and petroleum products was 92.47% and it corresponds to the year 1974. Nevertheless, we should also consider coal, coke and briquettes that during the first third of the period analysed had been present amounting an 8% on average of the total value of the imports basket (1962-1979). Nonetheless, since 1979, gas, natural and manufactured has been rising its importance amounting 12.59% of the weight of the basket, on average, during the last two thirds of the period (1979-2014).

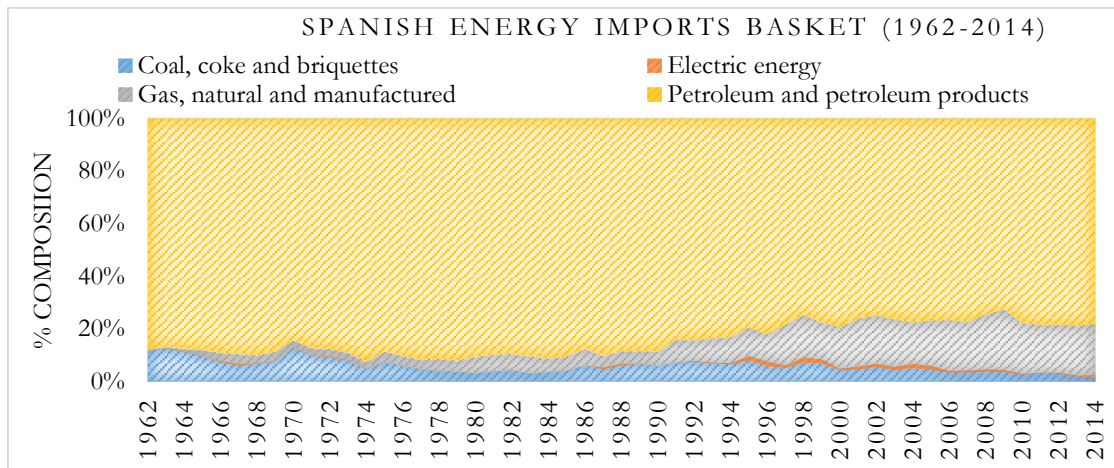


Fig.4

Source: Own compilation from COMTRADE database

In this point we have been talking about the different oil crisis. Given that Spain is a net oil importer, the country has been affected by the evolution of crude oil prices in form of macroeconomics fluctuations. Before moving into the next section of this descriptive analysis of Spain, it is worthy to have a brief explanation of how prices moved during the period covered in this study.

As we can appreciate on figure 5 between 1965 and 1973, average yearly prices per barrel adjusted for inflation to 2014 dollars remained quite constant being the average 13.20 \$/barrel. In 1973 the Yom Kippur War started with the beginning of an offensive of Syria and Egypt against Israel and as many western world countries showed their support to Israel, several Arab exporting nations imposed an embargo that more than tripled oil prices (in figure 9 from 17.53 \$/barrel to 55.62 \$/barrel) causing the first oil crisis. Between 1974 and 1978 prices remained constant with a 52.97 \$/barrel on average. The Islamic revolution of Iran and the war Iran-Iraq (1980-1988) caused the second world crisis and raised the barrels price to \$103.07 in 1979 and \$105.81 in 1980. Since 1981, prices started to decline and especially from 1986, when a price war started lowering barrel's price to \$33.56 (1986-1989). In 1990 prices peaked, however during the period 1991-2003 the average moved in 30.16 \$/barrel. In 2004 barrel's price started rising again as a direct consequence of the Arabic-Israeli conflict, the attacks suffered by Iraq and the social unrest in Nigeria and Venezuela reaching 106.94 \$/barrel. Nonetheless, in 2008 the financial bubble crashed causing a world economic crisis and reducing energy consumption, lowering barrel's price during 2009. In 2011 prices jumped again due to the Libyan civil

War reaching 117.09 \$/barrel and keeping over \$110 in 2012 and 2013. Since 2014 barrel's price has lowered due to the oil excess supply and a not very dynamic demand.²⁸

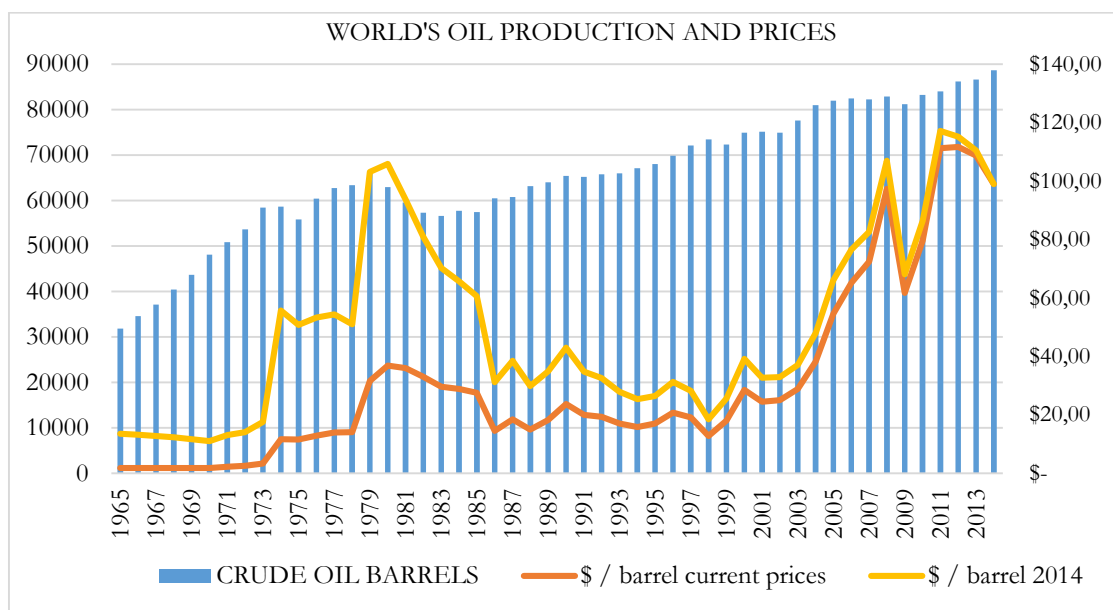


Fig.5 Source: Own compilation from BP statistical review of world energy 2015 workbook.²⁹ The graph has two vertical axes. The left axe measures the variable Crude Oil Barrels. The right axe measures the variables \$/barrel current prices and \$/barrel 2014

■ *Net energy imports*

What we can clearly observe on figure number 6 is that Spain has been a net energy importer during the whole period studied. Withal, we can identify three different tendencies. Between 1962 and 1985 the weight of net energy imports to total net imports has been increasing year by year until the point of reaching the second maximum value of the time series in 1985 where net energy imports represented 62.30% of net imports. Then during the period covering 1986 until 2007 its weight remained more or less stable at 25%. Nevertheless, with the last financial crisis and the third oil shock net energy imports weight has raised again to the point of reaching its peak in 2013 where net energy imports represented 70.53% of net imports. It can be said that the overall trade deficit of the Spanish economy was mostly an energy imports deficit. If the country could eliminate

²⁸ El estímulo, (2016). La vertiginosa historia del precio del petróleo. [online] Available at: <http://elstimulo.com/elinteres/la-vertiginosa-historia-del-precio-del-petroleo/> [Accessed 29 Apr. 2016]

²⁹ British Petroleum Company. (2015). BP statistical review of world energy. London: British Petroleum Co. Retrieved 16 April 2016, from <http://www.bp.com/content/dam/bp-country/de/de/PDFs/brochures/BP-statistical-review-of-world-energy-2014-full-report.pdf>

energy of its commercial balance, Spain would have a trade surplus as it was stated by BBVA RESEARCH.³⁰

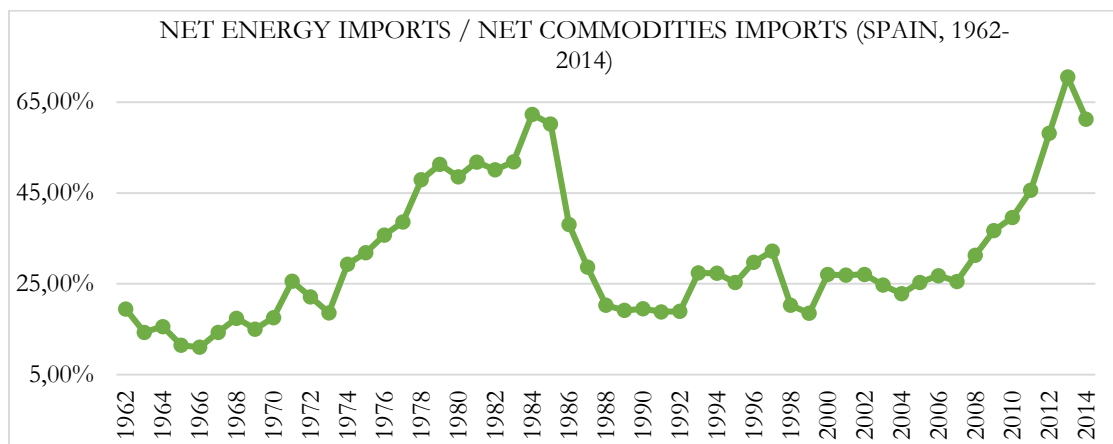


Fig.6

Source: Own compilation from COMTRADE database

▪ *Energetic importer effort*

Imports of energy supplies have always been very important and have had a great weight over the total Spanish imports of goods. Between the years 1962 and 1985 the importance of these energy imports had a clearly upward trend, accounting for almost 30% of the total value of goods imported during the first half of the 80's. Between 1985 and 2014 that weight has tended to stagnate at around 10-15%, although during the 21st century, especially since 2008 onwards, the weight of energy imports has experienced a slight increase that has placed the value of energy imports over 15-20% of total goods imports. It is quite remarkable that during the second half of the 1970s and first half of the 1980s energy imports were a quarter of total imports.

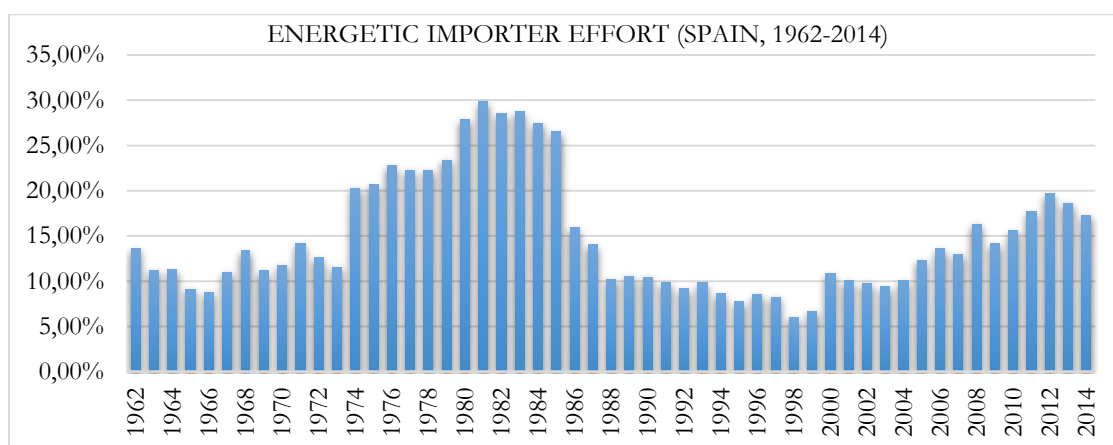


Fig.7 Source: Own compilation from COMTRADE database. Energetic importer effort is the ratio between energy imports and total goods imports.

³⁰ BBVA RESEARCH, (2013). España: balanza comercial de marzo 2013. Retrieved from https://www.bbva.com/wp-content/uploads/migrados/130517_Flash_Espana_BC_mar13_tcm346-387404.pdf

- *Energy imports coverage*

The following figure is really interesting and allows us to identify four different tendencies on energy imports coverage with goods exports. From 1962 to 1973 there exists a clearly declining tendency meaning that out of the total goods exported Spain, 30% of their trade value was needed for importing different energy supplies. However, from 1974 until 1985 (period which covers the 1970s energy crisis) the amount of goods exports needed in order to cover Spanish energy imports peaked, reaching a maximum of 67.08% during 1981. Hopefully, things changed after 1986 where this percentage started declining below 30%, reaching the series minimum in 1998 with 7.88%. Again and coinciding with another energy crisis (2000s), the percentage started rising in 2004 until the point of returning to nearly 30% in 2012 (28.21%).

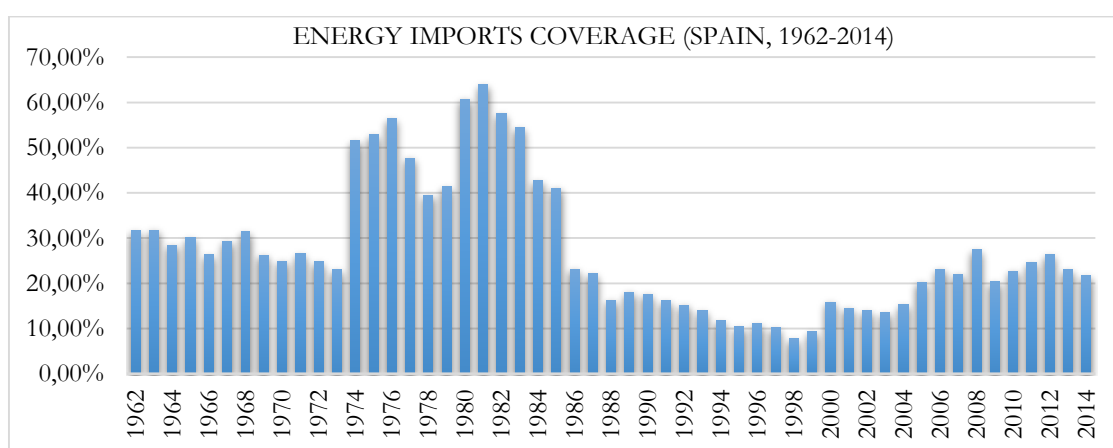


Fig.8 Source: Own compilation from COMTRADE database. Energy imports coverage is the ratio between energy imports and total goods exports.

With the arrival of the fifties, the gradual but incomplete liberalization allowed Spanish economy to take advantage of the favourable international conditions and regain some of the backwardness of the previous autarkic years. Between 1955 and 1973, both gross domestic product and energy consumption multiplied by 3.2, which meant a cumulative annual increase of 6.7%.³¹ This accentuated the dependence on irreplaceable energy supplies imports, which at the same time made difficult the task of maintaining the country's external balance, a key factor in the Spanish economic growth.

³¹ Sudriá, C (1997). "La restricción energética al desarrollo económico de España", Papeles de Economía Española, p. 179

We can perceive this last statement in the results obtained during this section, which show that during the second half of the 1960s, the 1970s and the first half of the 1980s (1965-1985), Spanish imports of energy supplies nearly reached a 30% of total imports and represented more than a 60% of total goods exports. It is more than likely that this phenomenon also has to do with the Arab-Israeli war that broke out on October 6, 1973 or with the second episode of rising prices that occurred in 1979-80 following the Iranian Islamic revolution and the subsequent war between Iran and Iraq. Between summer of 1973 and late 1981 the price of oil had risen from \$ 3 to \$ 34 per barrel.³²

During the 2000s the weight of energy imports over total goods imports and the energy imports coverage with goods imports started rising again. We have seen the petroleum and petroleum weight over the Spanish energy supplies imports baskets, so the steady price increase that started during the 2001 could have caused these increases in weights. If we consider the high level of dependence between world's economy and oil prices, the effects should be large and should not have only affected Spain. In order to prove it, I will proceed to make a comparison between Spain and OECD member countries.

4.2 OECD vs. SPAIN

Once we have analysed Spain, its turn to compare this Mediterranean country with the OECD member countries. This will allow us to discover whether the increased weight of energy imports over total imports and the worsening of its coverage with goods exports was something particularly Spanish, or endemic of OECD countries.

- *Exported energy supplies*

Over the 53 years of study (1962-2014), Spain is placed as the 13th energy supplies exporter of the OECD. The 5 largest OECD exporters of energy supplies have been Canada, Norway, United States, The Netherlands and United Kingdom.

³² Sudriá, C (1997). “La restricción energética al desarrollo económico de España”, Papeles de Economía Española, p. 180

Position	Country	Total exports
1	CANADA	\$ 1.522.296.896.894
2	NORWAY	\$ 1.426.948.866.579
3	UNITED STATES	\$ 1.192.812.508.299
4	NETHERLANDS	\$ 991.956.792.569
5	UNITED KINGDOM	\$ 985.137.215.227

Table 1

Source: Own compilation from COMTRADE database

On the other hand, the 5 smaller exporters of energy supplies in the OCED have been Iceland, Israel, Chile, Ireland and New Zealand. Luxembourg, Former Democratic Republic of Germany and Slovenia have been rejected because their data series are incomplete.

Position	Country	Total exports
30	NEW ZEALAND	\$ 19.271.636.901
31	IRELAND	\$ 16.665.335.160
33	CHILE	\$ 12.371.587.527
35	ISRAEL	\$ 5.918.611.742
37	ICELAND	\$ 800.121.197

Table 2

Source: Own compilation from COMTRADE database

As can be seen on figure 9, Spain has always been below the weighted average of the OECD countries in what refers to energy exports over total commodities exports with the exception of years 1963, 1966, 1967, 1968, 1969 and 1970. Energy exports have represented 4.44% of Spanish goods exports while the average for the OECD has been 10.84%. The series maximum for the OECD has been 18.12% in 1982 and 8.12% for Spain in 1985. The explanation for this performance below the OECD levels is that Spain, as we said in the introduction, has a small natural resources endowment which difficult the task of being an exporter of these kinds of goods (petroleum, coal, natural gas, electricity). The reason for being above the weighted average of the OECD during those years comprising the second half of the 1960s resides in the fact that the volume of Spanish

commodities exports was very small³³ and focused on foodstuffs so that the weight of exports of energy supplies saw enlarged as can be seen on table 3. Subsequently, once the Spanish export pattern changed to a larger number of consumer and capital goods and allowing an increase in terms of total volume, the weight of energy exports fell as its increase in volume was not in the same proportion as the increase in assets mentioned before. By contrast, throughout the period studied, the weight of these energy exports has seen its total weight increased in what the OECD concerns, mainly due to the increased production of crude oil barrels and prices that it is shown in figure 10.

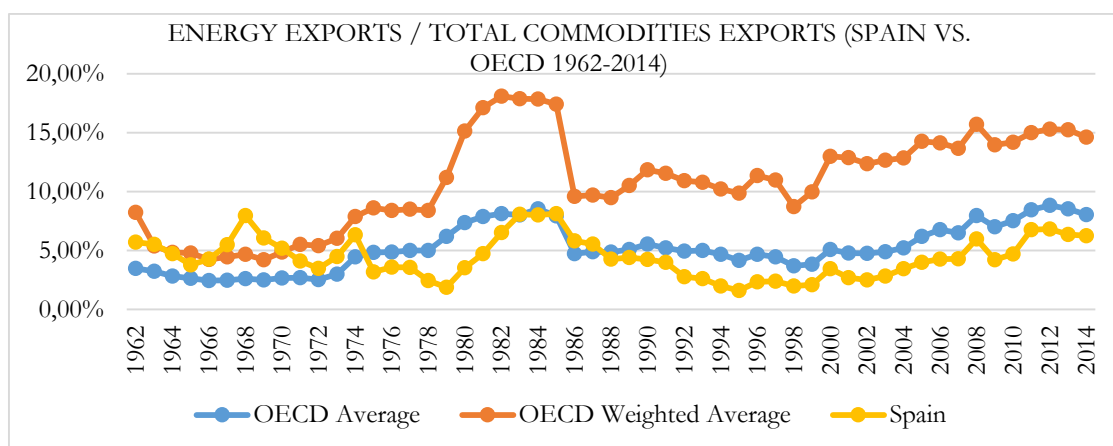


Fig.9

Source: Own compilation from COMTRADE database

Spain's Foreign Trade in 1961 and in 1970 (in US \$ million)								
	Imports				Exports			
	1961		1970		1961		1970	
		% of total		% of total		% of total		% of total
Foodstuffs	226,2	20,71	553,1	11,65	381,4	53,76	832,4	34,85
Fuels & Lubricants	178,1	16,31	630,4	13,28	41,9	5,91	131,1	5,49
Non-processed Products	215,6	19,74	805	16,96	68	9,59	110	4,61
Semi- Finished Products	196	17,94	1218	25,66	109,5	15,44	370,5	15,5
Consumer Goods	46,5	4,26	336,7	7,09	84,5	11,92	510,6	21,38
Capital Goods	230	21,07	1204	25,36	24,1	3,4	433,9	18,17
Capital for Agriculture	15	1,37	40,1	0,84	0,2	0,03	5,4	0,23
Capital for Industry	152,2	13,93	810,9	17,08	16,9	2,28	229,2	9,6
Capital for Services	62,7	5,74	353	7,44	7	0,99	199,3	8,34
Total	1092,3	100	4747,1	100	709,4	100	2388,5	100

Table 3

Source: González (1979) p.307

³³ González, M. (1979). La Economía política del franquismo (1940-1970): Dirigismo, mercado y planificación. Manuel Jesus González Gonzalez (p. 307). Editorial Tecnos.

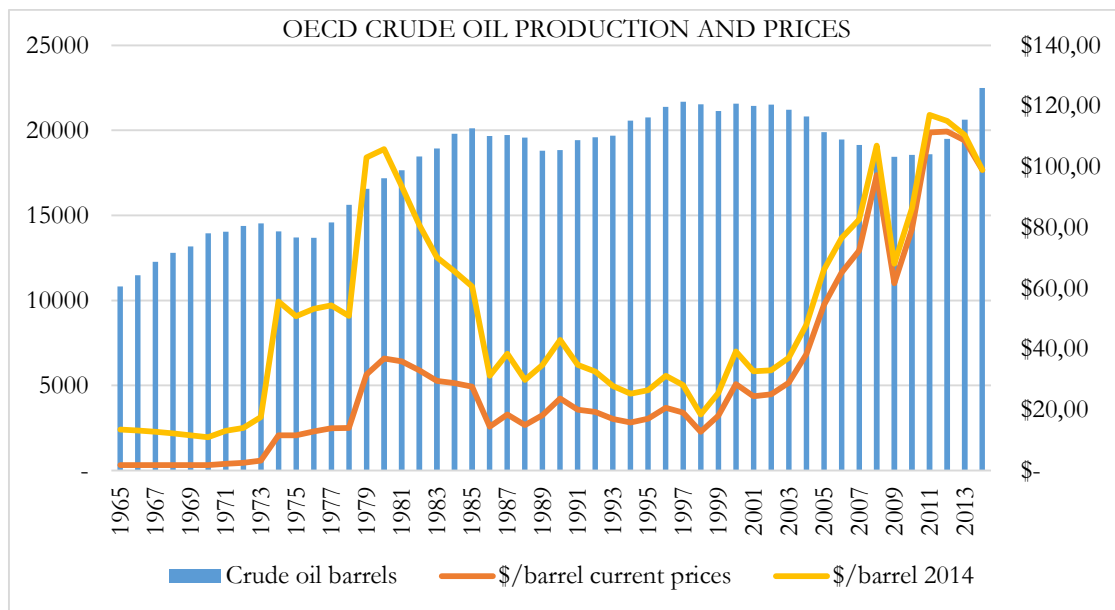


Fig.10 Source: Own compilation from BP statistical review of world energy 2015 workbook.³⁴ The graph has two vertical axes. The left axe measures the variable Crude Oil Barrels. The right axe measures the variables \$/barrel current prices and \$/barrel 2014

■ *Imported energy supplies*

Over the 53 years of study (1962-2014), Spain is located as the 9th largest energy importer. The top 5 largest importers of energy supplies is formed by United States, Japan, Germany, South Korea and France.

Position	Country	Total imports
1	UNITED STATES	\$ 6.069.433.962.490
2	JAPAN	\$ 3.888.943.450.883
3	GERMANY	\$ 1.856.413.350.642
4	SOUTH KOREA	\$ 1.760.455.997.295
5	FRANCE	\$ 1.657.735.602.481

Table 4 Source: Own compilation from COMTRADE database

On the other hand, the 5 smaller importers of energy supplies have been Iceland, New Zealand, Norway, Ireland and Hungary. Luxembourg, Former Democratic Republic of

³⁴ British Petroleum Company. (2015). BP statistical review of world energy. London: British Petroleum Co. Retrieved 16 April 2016, from <http://www.bp.com/content/dam/bp-country/de/de/PDFs/brochures/BP-statistical-review-of-world-energy-2014-full-report.pdf>

Germany, Estonia, Slovenia and Slovak Republic have been rejected because their data series are incomplete.

Position	Country	Total imports
28	HUNGARY	\$ 19.271.636.901
29	IRELAND	\$ 16.665.335.160
31	NORWAY	\$ 12.371.587.527
32	NEW ZEALAND	\$ 5.918.611.742
37	ICELAND	\$ 800.121.197

Table 5

Source: Own compilation from COMTRADE database

As we have explained in the introduction, Spain has always had to import most of its energy resources due to their poor resources endowment. This fact is confirmed since Spain has been the 9th largest importer, during the period covered by our study, in relation to the 37 countries that we have seen. Between the 1960s and 1980s, it is clear that Spanish energy imports over total commodities imports have been above the weighted average of the OECD. Nevertheless, during the 1990s and 2000s managed to perform below the weighted average of the OECD

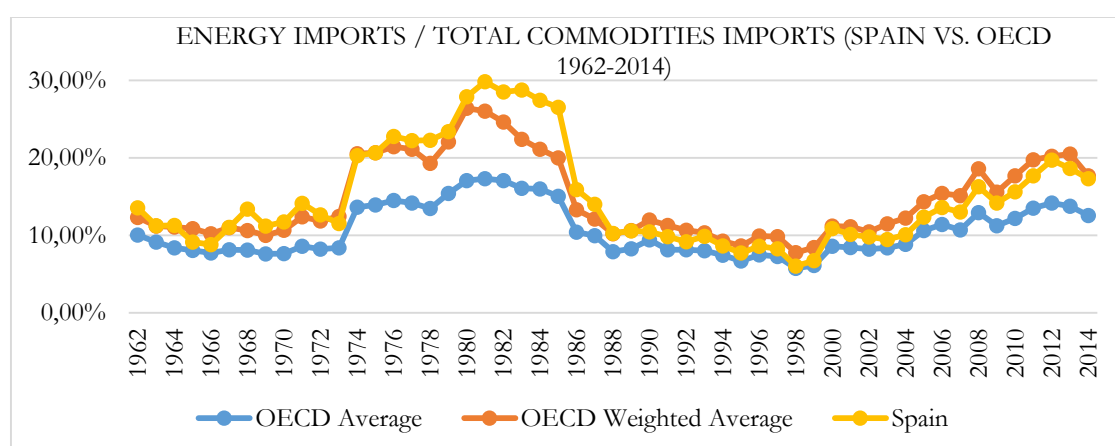


Fig.11

Source: Own compilation from COMTRADE database

▪ *Net energy imports*

Due to the different members that form the OECD, some may be classified as net energy supplies importers while others are net energy exporters. Once we stick to the data, we can see how most of the countries that make up this organization have acted as net energy supplies importers. This is the case of Austria, Belgium, Belgium-Luxembourg, Chile, Czech Republic, Estonia, Finland, Former Democratic Republic of Germany, Former Federal Republic of Germany, France, Germany, Greece, Hungary, Iceland, Ireland, Israel, Italy, Japan, South Korea, Luxembourg, New Zealand, Poland, Portugal, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, Turkey and United States.³⁵

On the other hand, we have those countries that have either been net energy supplies exporters during most of the period studied or at least for some years. This is the case of Australia, Canada, Denmark, Mexico, The Netherlands and The United Kingdom.³⁶

In what refers to the composition of the energy supplies imports basket of the different countries analysed, the main energy supply has been Petroleum and Petroleum products. However, the energy supplies of the net energy exporters vary a little more so we will get a little more in detail.

- Australia is a country that has mainly exported coal, coke and briquettes (66.68% on average) and Petroleum and petroleum products (24.91% on average) between 1963 and 2014.
- Canada is a country that has mainly exported petroleum and petroleum products (56.44% on average) and Gas, natural and manufactured (30.69%) between 1962 and 2014.
- Denmark has primarily exported mainly petroleum and petroleum products (86.54% on average) and Electric Energy (10.60% on average) between 1962 and 2014.
- Mexico has essentially exported petroleum and petroleum products (94.91% on average) between 1962 and 2014.
- The Netherlands has principally exported petroleum and petroleum products (75.63% on average) and Gas, natural and manufactured (19.24%) between 1962 and 2014.
- The United Kingdom is a country that has primarily exported petroleum and petroleum products (91.05% on average) between 1962 and 2014.

³⁵ You can find more information on Appendix A

³⁶ You can find more information on Appendix A

- *Energetic importer effort*

Figure 12 is really compelling and shows very well what Spain faced between 1962 and 1988 when the country was doing a higher importer effort than the weighted average of the OECD member countries during most of the years. Between 1978 and 1984 Japan and Turkey, and since 1984 Japan, were the only OECD countries making a greater importer effort than Spain.³⁷ This had to be something fatal for Spanish, Japanese and Turkish economies since surely obliged these economies to quit from importing other goods such as machines, technology or food.

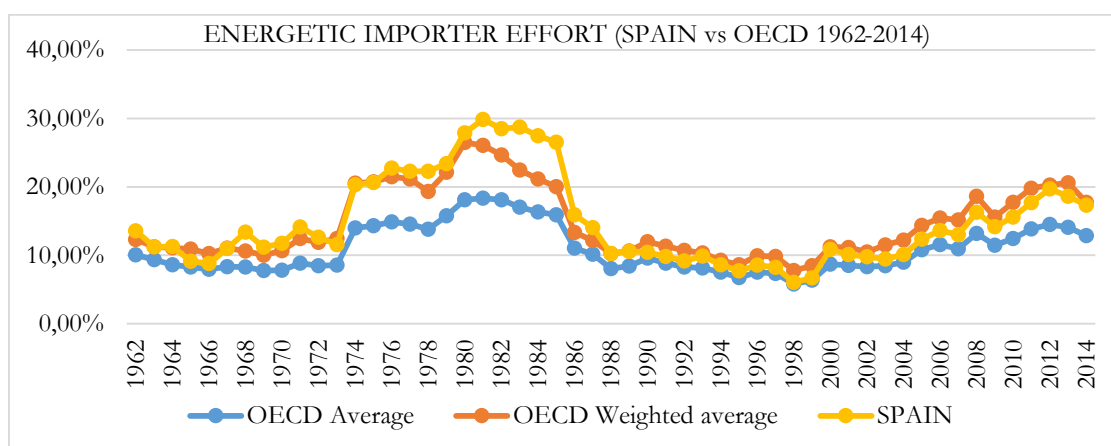


Fig.12 Source: Own compilation from COMTRADE database. Energetic importer effort is the ratio between energy imports and total goods imports.

On the one hand, it is quite remarkable that from 1988 on, the Spanish economy has been performing below the weighted average of the OECD. The reason behind this improvement has to do with the several national energy plans which aimed to diversify Spanish energy sources and reduce its energy vulnerability. They include the natural gas introduction, the liberalisation of the energy sector and the promotion of renewables.³⁸ Since the beginning of the liberalisation, the number of agents has grown due to the entrance new national and international actors such as oil companies (BP, Galp), construction companies (Sacyr, ACS, Acciona) or international funds (Qatar investment Authority).³⁹

³⁷ You can find more information on Appendix B

³⁸ You can find more information about the Spanish energy policy main period on Annex 1 of Álvarez, E. y Larrea, M., Energy policy: European challenges, Spanish answers. Policy paper 106, March 2014. Notre Europe. Jacques Delors Institute.

³⁹ Álvarez, E. y Larrea, M., Energy policy: European challenges, Spanish answers. Policy paper 106, March 2014. Notre Europe. Jacques Delors Institute, p. 20-21.

On the other hand, Spanish energy dependence is 73%, well above the European, which is around 50%.⁴⁰ The Mediterranean country has a heavy dependence on fossil fuel imports, however we can appreciate a shift from petroleum to natural gas since petroleum products imports have decreased between 2000 and 2012 from 71 Mtoe to 59 Mtoe whereas natural gas imports have risen from 15 Mtoe to 28 Mtoe during the same time period. Moreover, during the 21st century renewable energies have been growing thanks to the financial support provided to these sources and the wide availability of wind and solar resources that can be found in the country.⁴¹

It seems that the Spanish energy policy has improved significantly compared to the initial situation in the 60's. After all there is still a long way to go before assuring Spanish population energy welfare and decrease even more its importer effort.

- *Energy imports coverage*

In figure 13 we can realize the delicate Spanish situation with regard to other OECD economies. Between 1962 and 2014, Spanish energy imports coverage with good exports has been 1.49 times higher than the weighted average of the OECD, reaching a maximum of 2.487 times in 1968. Between 1964 and 1974, with the exception of Greece in 1972 and 1973, Spain was the country whose energy supplies imports represented a higher percentage of its goods exports. Since 1975 and until the European integration in 1986 Spain remained in the top 3 of this ratio being surpassed only by Turkey and since 1982 by Turkey and Greece. From 1986 until the 2007-2008 oil shock, it seems that Spain began to converge to the weighted average of the OECD, but always remaining above (1.14 times for the period 1986-2014). It is noteworthy that during the 21st century, Greece has been the country that has required a greater volume of exports to cover its energy imports (44.35% for the period 2000-2014).⁴²

⁴⁰ Deloitte Conseil, (2015). *European energy market reform Country profile: Spain* (p. 2).

⁴¹ Deloitte Conseil. (2015). *European energy market reform Country profile: Spain* (p. 12).

⁴² You can find more information on Appendix C

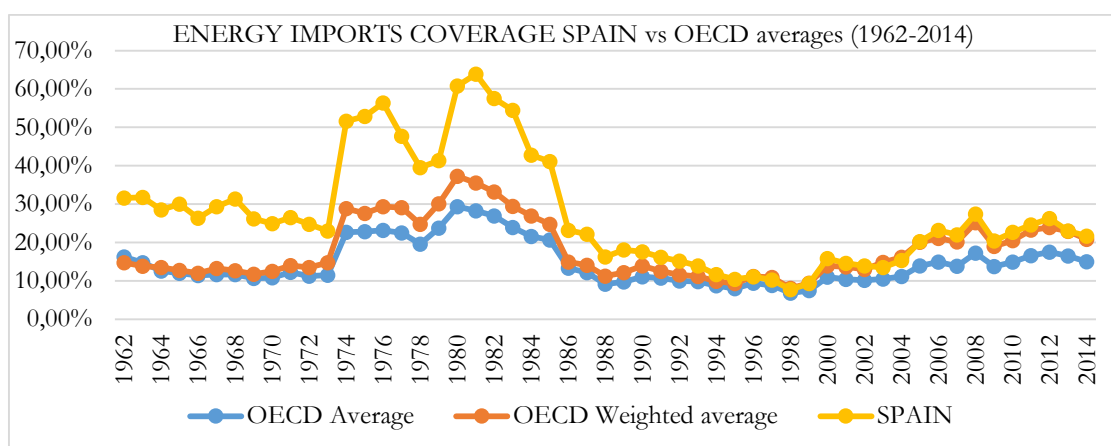


Fig.13 Source: Own compilation from COMTRADE database. Energy imports coverage is the ratio between energy imports and total goods exports.

5. DATA, MODEL AND EMPIRICAL RESULTS^{43,44}

As we have stated in the previous point throughout the descriptive analysis that we carried out, Spain is an exceptional case and differs greatly from the rest of the OECD members. This Mediterranean country has been extremely dependant on fossil fuels and especially on petroleum and petroleum products due to the lack of this natural resource in their territory.

We have partially solved this bachelor's thesis main objective seeing that we have confirmed that the energy burden that has faced Spain has been something very exclusive of the country. Now is turn to continue on the matter in detail. In the introduction we commented that Spaniards have always complained about their energy burden claiming that it has adversely affected the nation's economic growth. In this section we will try to test the hypothesis that energy burden has negatively affected countries and if it really matters in what economic development concerns, so that the Spanish complaints would be justified.

In order to test this hypothesis we collected data for OECD countries so that we can observe their behaviour. The multivariate framework encompasses GDP per capita annual growth (variable: growth), Net Energy Imports coverage (variable: energy), and few dummy variables presence or not of the country in the European continent (variable: europe), if the countries are oil exporters or not (variable: exporter) and last but not least if the countries had indigenous oil production (variable: production). A panel data analysis was the most interesting tool and since the variables were already expressed as percentages natural logarithms were not required.

⁴³ Rubio, M. & Tafunell, X. (2014). Latin American hydropower: A century of uneven evolution. *Renewable And Sustainable Energy Reviews*, 38, 323-334. <http://dx.doi.org/10.1016/j.rser.2014.05.068>

⁴⁴ Menegaki, A. (2011). Growth and renewable energy in Europe: A random effect model with evidence for neutrality hypothesis. *Energy Economics*, 33(2), 257-263. <http://dx.doi.org/10.1016/j.eneco.2010.10.004>

The technique used in order to analyse our panel data was a random-effects (RE) model. This decision was due to the heterogeneity of countries that we had in our dataset. We have to take into account that fixed-effect (FE) models are usually preferred due to their simplicity in handling and normalizing heterogeneity in the error term. However, we selected a RE model because we conceived each country as a random variable being part of a larger population of countries, so we had reasons to believe that the differences across countries had some kind of influence on the GDPpc increase from year to year. An advantage of RE models is that we can include time invariant variables (i.e. European continent) that in FE are absorbed by the intercept.

What we expected to obtain as a result of our model is that those countries allocating a higher percentage of their good exports with the purpose of covering its energy imports should have smaller GDPpc growth than those with lower percentages. On the other hand we believe that belonging to the European territory as well as being net oil exporter or having indigenous oil production should positively affect the growth of GDP per capita.

In all our models, the dependent variable is the GDPpc annual rate of growth. The first model just wants to test the hypothesis while the second, third and fourth want to prove its robustness.

$$growth_{it} = c + b_1energy + u_i + e_{it} \quad (1)$$

The second model includes the presence or not of the countries into the European continent taking the value 1 if the country can be found in Europe and 0 otherwise.

$$growth_{it} = c + b_1energy + b_2europe + u_i + e_{it} \quad (2)$$

Being a net crude oil exporter enters the equation as a dummy variable which takes the value 1 if the country is a net oil exporter and 0 otherwise.

$$growth_{it} = c + b_1energy + b_2europe + b_3exporter + u_i + e_{it} \quad (3)$$

The fourth equation adds the variable indigenous oil production receiving the value 1 if the country has it or 0 otherwise.

$$growth_{it} = c + b_1energy + b_2europe + b_3exporter + b_4production + u_i + e_{it} \quad (4)$$

Where:

- $growth_{it}$ is the dependent variable where i =country and t =year

- c is the constant
- β_k is the coefficient for that variable
- u_{it} is the between-entity error term
- e_{it} is the within-entity error term

Model Number	(1)	(2)	(3)	(4)
Dependent Variable: <i>growth</i>				
<i>energy</i>	-0.0354658***	-0.0359805***	-0.0382451***	-0.0339258***
<i>europe</i>		-0.00161739	-0.00257483	-0.00427624
<i>exporter</i>			-0.00909553	-0.00405220
<i>production</i>				-0.00940314***
<i>Constant</i>	0.0316445***	0.0328088***	0.0349897***	0.0398769***
<i>Observations</i>	1309	1309	1309	1277
<i>Number of Countries</i>	32	32	32	30
<i>Time FE</i>	Yes	Yes	Yes	Yes
<i>Var "within"</i>	0.000908268	0.000908268	0.000908268	0.000866058
<i>Var "between"</i>	8.59836e-005	8.98357e-005	9.37707e-005	5.70037e-005
<i>R-sq overall</i>	0.000325547	0.000535456	0.00367762	0.0190703

Table 6 Empirical results Source: Own compilation.

*** p<0.01 ** p<0.05 *p<0.1

The sample was balanced and the explanatory power of the model created is satisfactory since long-run estimates can be derived from our model due to its robustness. The results indicate that 1% increase in Net energy imports coverage causes a 0,034% decrease in GDP per capita growth confirming the energy burden has a negative effect on nation's economic growth, justifying Spanish complains. Contrary to our thoughts, the sign of belonging the European continent is negative. The reason behind this could be that the departing GDPpc of European countries is greater and therefore the growth experienced on it is smaller compared to that of those countries outside this territory however the p-value of this variable is not significative. Indigenous oil product has also a negative sign and

the logic behind it could be that countries such as Italy, Spain, Turkey or Poland had indigenous oil production but are net importers of this product.

6. CONCLUSIONS

Studies about this topic have found, in general, a strong causal relationship between energy consumption and economic growth but they are inconclusive about the direction of the causality and the magnitude of its impact.

The purpose of this project is to introduce a different view by looking at energy supplies imports and exports in order to prove the hypothesis relating economy and energy. We analysed the relationship from a different angle while trying to answer the question of whether the ease of access to energy had any impact on economic growth. The hypothesis that we test is if countries with more difficulties to access energy had a worse economic performance than those countries which have an easier access.

The first conclusion is that the Spanish energy burden has been something very particular of the Mediterranean country. Between 1962 and 1988 Spain was doing a higher importer effort than the weighted average of the OECD. Moreover, Spanish energy imports coverage with good exports has been higher than the weighted average of the OECD. From 1964 to 1974 Spain was the country whose energy supplies imports represented a higher percentage of its total goods exports.

The next conclusion is that the European integration of Spain has favoured the country in reducing its energetic importer effort. The reason resides on the several energy plans that aimed to diversify energy sources and energetic dependence. Nevertheless, the country's energy dependence is well above the European.

Once this question was solved, the next step was to study the relationship between net energy imports coverage and GDP growth. A random-effects model was developed and it showed that those countries that require a larger amount of their total goods exports in order to cover their net energy imports suffer a negative impact on their GDP per capita growth, confirming our hypothesis and reinforcing the constant Spanish complains.

We can conclude that countries with more difficulties to access energy had a worse economic performance than those which have an easier access. This hypothesis is supported throughout both a descriptive and empirical analysis based on the OECD member countries, covering the period 1962-2014.

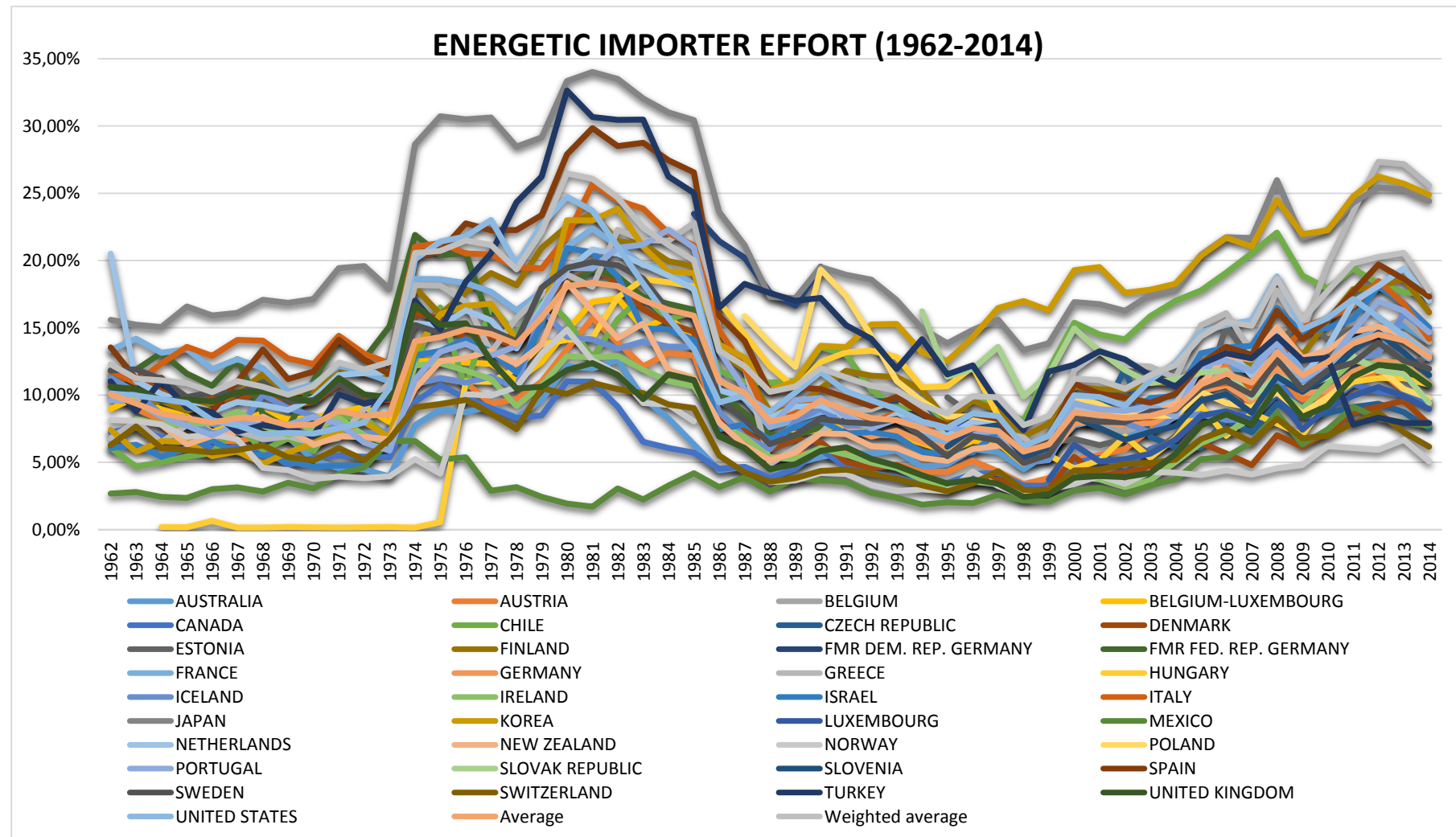
7. APPENDIX

7.1 Appendix A

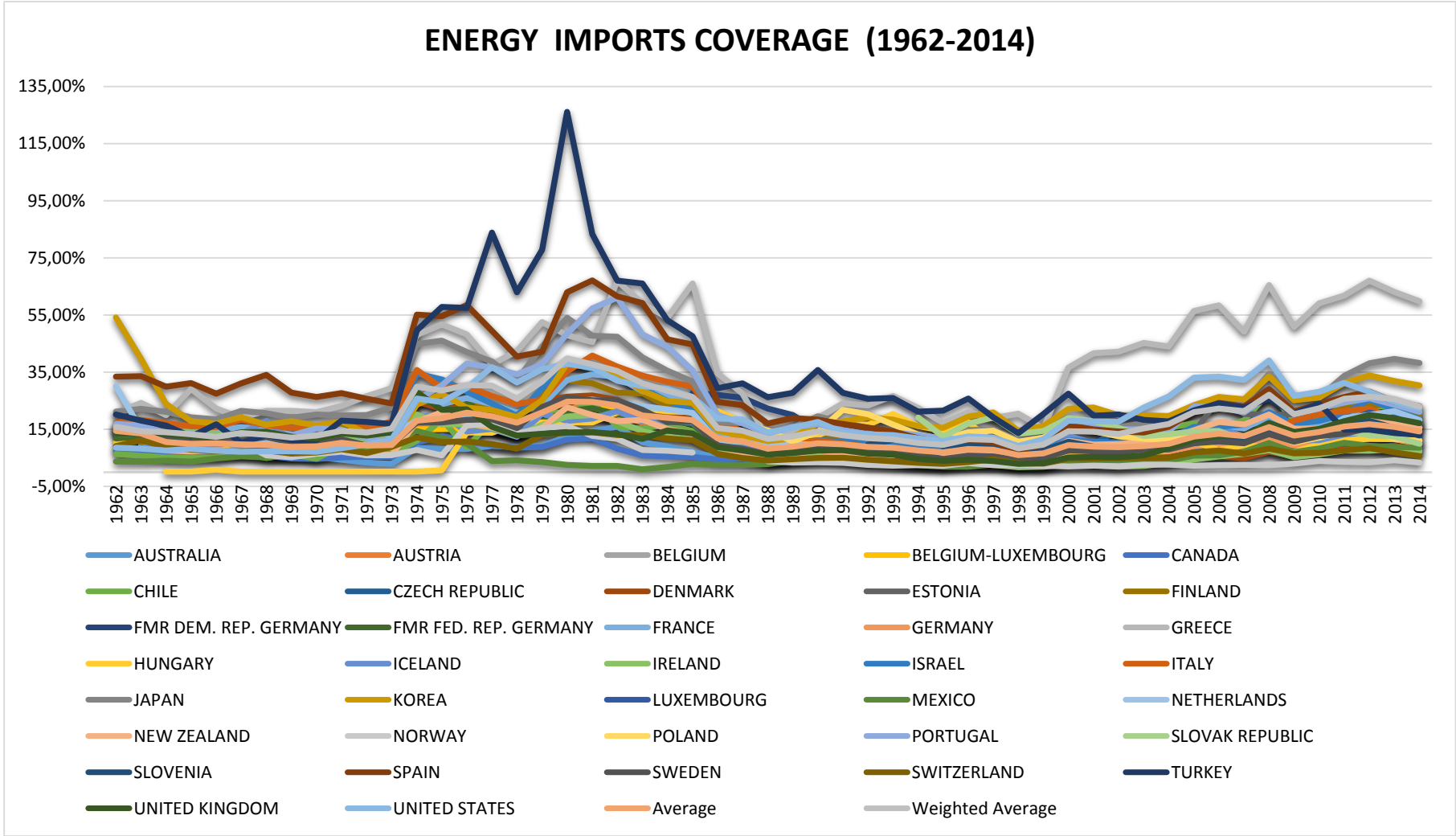
<i>COUNTRY</i>	NET IMPORTER	NET EXPORTER
<i>AUSTRALIA</i>	1963-1969	1970-2014
<i>AUSTRIA</i>	1963-2014	
<i>BELGIUM</i>	1999-2014	
<i>BELGIUM-LUXEMBOURG</i>	1962-1998	
<i>CANADA</i>	1963-1968	1962, 1969-2014
<i>CHILE</i>	1962-2014	
<i>CZECH REPUBLIC</i>	1993-2014	
<i>DENMARK</i>	1962-1995, 2013-2014	1996-2012
<i>ESTONIA</i>	1995-2014	
<i>FINLAND</i>	1963-2014	
<i>FMR DEM. REP. GERMANY</i>	1985-1990	
<i>FMR FED. REP. GERMANY</i>	1962-1990	
<i>FRANCE</i>	1962-2014	
<i>GERMANY</i>	1991-2014	
<i>GREECE</i>	1962-2014	
<i>HUNGARY</i>	1964-2014	
<i>ICELAND</i>	1962-2014	
<i>IRELAND</i>	1963-2014	
<i>ISRAEL</i>	1962-2014	
<i>ITALY</i>	1962-2014	
<i>JAPAN</i>	1962-2014	

<i>KOREA</i>	1962-2014	
<i>LUXEMBOURG</i>	1999-2014	
<i>MEXICO</i>	1966-1974	1962-1965, 1975-2014
<i>NETHERLANDS</i>	1962-1982, 1988-1990, 1997, 1999-2014	1983-1987, 1991-1996, 1998
<i>NEW ZEALAND</i>	1964-2014	
<i>NORWAY</i>	1962-1974, 1977	1975-1976, 1978-1985, 1988-2014
<i>POLAND</i>	1984, 1987-2014	
<i>PORTUGAL</i>	1962-2014	
<i>SLOVAK REPUBLIC</i>	1994-2014	
<i>SLOVENIA</i>	1992-1993, 1995-2014	
<i>SPAIN</i>	1962-2014	
<i>SWEDEN</i>	1962-2014	
<i>SWITZERLAND</i>	1962-2014	
<i>TURKEY</i>	1962-2014	
<i>UNITED KINGDOM</i>	1962-1980, 1989, 1991-1992, 2005-2014	1981-1988, 1990, 1993-2004
<i>UNITED STATES</i>	1962-2014	

7.2 Appendix B



7.3 Appendix C



8. REFERENCES

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